Precalc Warm Up # 4-4

Solve for x (exact if possible or 4 d.p.)

1. $3^{2x} - 3^{x+3} = 90$

2. $(x-3)^{x^2+4} = (x-3)^{5x}$

3. $\dfrac{4^x}{4^x + 6} = \dfrac{1}{5}$

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3. $\dfrac{4^x}{4^x+6} = \dfrac{1}{5}$ Cross multiply.

$5(4^x) = 4^x + 6$

$5(4^x) - 1(4^x) = 6$

$4(4^x) = 6$

$4^x = \frac{6}{4}$

$\ln 4^x = \ln\left(\frac{3}{2}\right)$

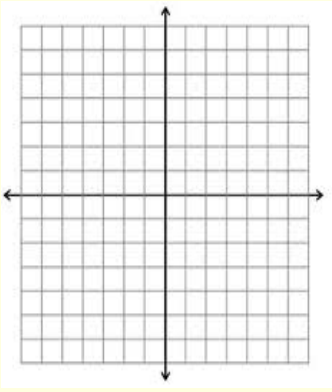
$\frac{x \ln 4}{\ln 4} = \frac{\ln\left(\frac{3}{2}\right)}{\ln 4}$

$x \approx 0.2925$

HW Questions p. 295

In Exercises 1–16, sketch the graph of the function.

3. $g(x) = 6^{-x}$



In Exercises 17–24, use the properties of logarithms to write the expression as a sum, difference, or multiple of logarithms.

19. $\log_{10} \dfrac{5\sqrt{y}}{x^2}$

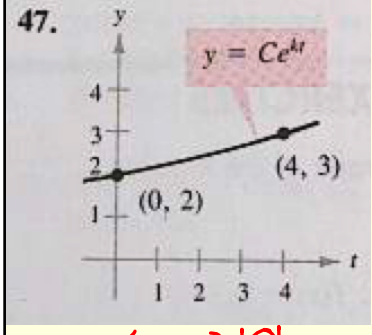
In Exercises 25–32, write the expression as the logarithm of a single quantity.

25. $\log_{10} 5 - 2\log_{10}(x + 4)$

31. $\ln 3 + \frac{1}{3}\ln(4 - x^2) - \ln x$

In Exercises 47–50, find the exponential function $y = Ce^{kt}$ that passes through the two points.

47.

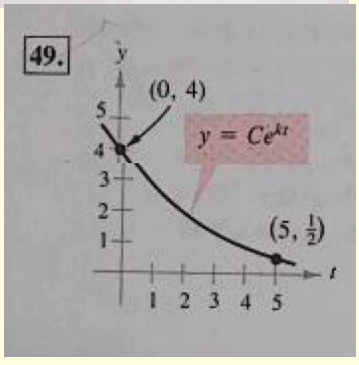


$k \approx 0.101$

$y = 2e^{\approx 0.101t}$

$y = 2e^{(\ln\frac{3}{2})t}$

49.



$y = 4e^{\approx -0.416t}$

$\frac{1}{2} = 4e^{kt}$

$\frac{1}{8} = e^{k(5)}$

53. A deposit of \$750 is made in a savings account for which the interest is compounded continuously. The balance will double in $7\frac{3}{4}$ years.
(a) What is the annual percentage rate for this account?
(b) Find the balance in the account after ten years.
(c) Find the effective yield. → $(1+r)$

a) $\frac{1500}{750} = \frac{750e^{r(7.75)}}{750}$

$2 = e^{7.75r}$

$\frac{\ln 2}{7.75} = \frac{7.75r}{7.75}$

$r \approx 0.0894$ → STORE as A (STO→ A)

$\approx 8.94\%$

$P(1.0894)$

c) $A = P[e^{r(1)}]$

Compare ↑ to $(1+r)$

$e^A \approx 1.0936$

9.36%

From the review WS:

7f) $\frac{3^x}{3^x + 3} = \frac{1}{3}$ Let $y = 3^x$

$3 \cdot 3^x = 3^x + 3$ → $3y = y + 3$

$-3^x \quad -3^x$ $\quad -y \quad -y$

$2y = 3$

$\frac{2 \cdot 3^x}{2} = \frac{3}{2}$

$\frac{x \ln 3}{\ln 3} = \frac{\ln 1.5}{\ln 3}$

$A = P(1 + 0.068)^1 \longrightarrow 1.068$

6.8%

$A = P\left(1 + \frac{0.068}{4}\right)^{4(1)}$

$\left(\frac{4.068}{4}\right)^4 \approx 1.0698$

6.98%

from page 2...

1c) from a) $\longrightarrow$ $k = \frac{\log(0.25)}{-40}$ (STORED)

$\frac{1}{2}\ell = \ell \cdot (10)^{-kt}$

$0.5 = 10^{\left(\frac{\log 0.25}{40}\right)t}$

$\frac{\log 0.5}{\left(\frac{\log 0.25}{40}\right)} = \frac{\left(\frac{\log 0.25}{40}\right)t}{\left(\frac{\log 0.25}{40}\right)}$

$t \approx$

3) initial

$y = Ce^{kt}$

$6 = \frac{1}{2}e^{k(4)}$

$12 = e^{4k}$

$\frac{\ln 12}{4} = \frac{4k}{4}$

$(0, \frac{1}{2}) \rightarrow \boxed{C = \frac{1}{2}}$

$\frac{1}{2} = Ce^{k(0)}$

$\frac{1}{2} = C$

Same as: $y = Pe^{rt}$

4. $\log_a b = 5 \quad \log_a c = 0.2$

$\log_a \left(\frac{\sqrt{b}}{ac^3}\right)$

$\log_a b^{1/2} - \log_a (ac^3)$

$\frac{1}{2}\log_a b - (\log_a a + \log_a c^3)$

$\frac{1}{2}(5) - 1 - 3\log_a c$

$\frac{5}{2} - 1 - 3(0.2)$

Test Review:

Solve. (exact if possible or 4 d.p.)

1) $\ln(x-2) + \ln(2x-3) = 2\ln x$

$\ln[(x-2)(2x-3)] = \ln x^2$

$2x^2 - 7x + 6 = x^2$

$x^2 - 7x + 6 = 0$

$(\quad)(\quad) = 0$

2) $4 - e^{-6x} = 1$

$3 = e^{-6x}$ $= 1$

$\ln 3 = -6x(\ln e)$

$x = \frac{\ln 3}{-6}$

$x \approx$

Solve. (exact if possible or 4 d.p.)

1) $3^{2x} - 3^{x+3} = 90$

$(3^x)^2 - 3^x \cdot 3^3 = 90$

let $y = 3^x$

$y^2 - 27y - 90 = 0$

$(3^x - 30)(3^x + 3) = 0$

$3^x = 30 \quad 3^x \neq -3$

$x = \frac{\ln 30}{\ln 3}$

$x \approx$

2) $4 - e^{-6x} = 1$

$4 - 1 = e^{-6x}$

$3 = e^{-6x}$

$\frac{\ln 3}{-6} = \frac{-6x}{-6}$

$x \approx -0.183$

3) $(\log x)^2 - 11 \log x = -10$

$(\log x - 1)(\log x - 10) = 0$

$\log x = 1$ $\quad$ $\log x = 10$

$x = 10$ $\quad$ $x = 10^{10}$

4) $e^{2x} - 5 = 4e^x$

$(e^x)^2 - 4e^x - 5 = 0$

$(e^x - 5)(e^x + 1) = 0$

$e^x = 5$ $\quad$ $e^x \neq -1$

$x = \ln 5$

$x \approx$

5. $\log x + 3\log x = 12$

$\log x + \log x^3 = 12$

$\log x^4 = 12$

$10^{12} = x^4$

$(10^3)^4 = x^4$

$x = 10^3$

$x = 1000$

or: Combine like terms!

$4\log x = 12$

$\log x = 3$

$10^3 = x$

$x = 1000$

6. $\log(x-1) - 2\log x = -\log 2x$

$\log(x-1) - \log x^2 = \log(2x)^{-1}$

$\log \frac{x-1}{x^2} = \log \frac{1}{2x}$

$\frac{x-1}{x^2} = \frac{1}{2x}$

$2x^2 - 2x = x^2$

$x^2 - 2x = 0$

$x(x-2) = 0$

$x = 0, 2$ → but $x = 0$ is extraneous

$\boxed{x = 2}$

HW: SL book, p. 277

1 parts 1, 2, 5, 17, 18

2ad

(for 2d: assume rectangle, not square!)

Unit Test: tomorrow

PC 4.1-4.5, SL 7.1, 7.4